# I. THE CLEMMENSEN REDUCTION-REARRANGEMENT OF PHENYL-SUBSTITUTED α-AMINOKETONES

# II. THE ELECTROLYTIC REDUCTION OF TRICYCLIC α-AMINOKETONES

BY

GLENN FULLER

B. S., Stanford University, 1950
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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN CHEMISTRY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1953

URBANA, ILLINOIS
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# I. THE CLEMMENSEN REDUCTION-REARRANGEMENT OF PHENYL-SUBSTITUTED α-AMINOKETONES

## Introduction

The Clemmensen reduction-rearrangement of α-aminoketones has been extended to include several unsubstituted and alkyl-substituted α-aminoketones, both monocyclic and bicyclic (1). It was considered of interest, however, to examine the influence, if any, of aromatic substitution in the aminoketone molecule. The purpose of this investigation was to study the effect, on the rearrangement, of a phenyl-substituent on the nitrogen atom or on the α- or γ-carbon atoms of the aminoketone molecule.

## Discussion of Results

The phenyl-substituted α-aminoketones were made by Dieckmann cyclization procedures and were reduced under Clemmensen conditions. Clemmensen reduction of 1-phenyl-3-piperidone led to the formation of 1-phenyl-2-methylpyrrolidine, the expected product from normal rearrangement. The product isolated from reduction with zinc amalgam and hydrochloric acid of 1-ethyl-2-phenyl-3-piperidone was 1-ethyl-2-benzylpyrrolidine, also a product of normal rearrangement. A sample of the hydrochloride of 1-methyl-4-phenyl-3-piperidone, kindly furnished by S. M. McElvain (2) was reduced with rearrangement to 1,2-dimethyl-3-phenylpyrrolidine.

These data indicate that, although yields are somewhat lower from the phenyl-substituted series of monocyclic α-aminoketones, rearrangement attends reduction.

## BIBLIOGRAPHY

1. For the leading article in the series, see N. J. Leonard, R. C. Sentz and W. J. Middleton, J. Am. Chem. Soc., **75**, 1674 (1953).

2. S. M. McElvain and P. M. Laughton, *ibid.*, **73**, 448 (1951).

## II. THE ELECTROLYTIC REDUCTION OF TRICYCLIC α-AMINOKETONES

### Introduction

Leonard, Swann, Figueras and Mottus (1,2) have employed electrolytic reduction of certain bicyclic α-aminoketones to synthesize medium-ring heterocycles having nine, ten, eleven and twelve members. The purpose of this investigation was to prepare and reduce some partially aromatic tricyclic α-aminoketones in order to obtain medium-sized ring compounds having a benzo-grouping fused to the larger ring.

### Discussion of Results

Four α-aminoketones were prepared and were reduced at a lead cathode in 30% sulfuric acid at a temperature of 60°. These ketones were prepared by Dieckmann cyclization reactions, using special high-dilution procedures (3) for the seven- and eight-membered ring α-aminoketones.

The electrolytic reduction of the six-six-five fused ring system, benzo[c]-7-keto-1-azabicyclo[4.3.0]nonane, led to the formation of benzo[c]-1-azabicyclo[4.3.0]nonane and a mixture of aminoalcohols. Reduction of the six-six-six tricyclic system, benzo[c]-7-keto-1-azabicyclo[4.4.0]decane, formed benzo[c]-1-azabicyclo[5.3.0]decane, the product also obtained from Clemmensen reduction of the aminoketone, and a mixture of aminoalcohols. The products isolated from reduction at a lead cathode of the six-six-seven fused ring α-aminoketone, benzo[i]-6-keto-1-azabicyclo [5.4.0] hendecane, were benzo[c]-1-azabicyclo[5.4.0]hendecane, the Clemmensen reduction-rearrangement product, and the eleven-membered ring aminoalcohol, benzo[c]-7-hydroxyazacyclohendecane. The six-six-eight tricyclic α-aminoketone, benzo[j]-7-keto-1-azabicyclo[6.4.0]dodecane, was reduced to the twelve-membered ring aminoalcohol, benzo[c]-7-hydroxyazacyclododecane, and a tricyclic amine tentatively identified as benzo[c]-1-azabicyclo[5.5.0]dodecane.

Electrolytic reduction, therefore, may be used as a method of synthesis for medium-ring compounds having a benzo-

grouping fused to the larger ring. However, isolation of the medium-ring compounds is complicated by the presence of products of side reactions.

## BIBLIOGRAPHY


1. N. J. Leonard, S. Swann, Jr.and J. Figueras, Jr., J. Am. Chem. Soc., **74**, 4620 (1952).
2. N. J. Leonard, S. Swann, Jr. and E. H. Mottus, *ibid.*, **74**, 6251 (1952).
3. N. J. Leonard and R. C. Sentz, *ibid.*, **74**, 1704 (1952).

## VITA

The author was born on May 18, 1929, in Lancaster, California. He attended public schools in California and Oregon, and was graduated from Burbank High School in Burbank, California, in 1946. He entered Stanford University the same year, and received the degree of Bachelor of Science with great distinction from that institution in 1950. He entered the graduate school at the University of Illinois at that time, and received the degree of Master of Science the following year. He held University Fellowships during the academic years 1950-51 and 1951-52 and a National Science Foundation Fellowship in 1952-53.